DOCUMENT RESUME

ED 206 912 CE 030 105

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TITLE Training for Middle Level Skills.
INSTITUTION Ontario Dept. of Education, Toronto.
PUB DATE 81
NOTE 29p.
AVAILABLE FROM Ontario Government Bookstores, 880 Bay St., Toronto, Ontario M7A 1N8 ($3.00).
JOURNAL CIT Review and Evaluation Bulletins; v2 n3 1981

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Demand Occupations; Education Work Relationship; Labor Market; *Labor Needs; *Labor Supply; *Skilled Workers; *Trade and Industrial Education; *Two Year Colleges
IDENTIFIERS *Colleges of Applied Arts and Technology; *Ontario

ABSTRACT

Since high technology industries are expected to play an important role in Ontario's future economic development, the educational system must be particularly attuned to the need for middle-level skills in the labor market. The rapid increase in new labor market entrants with middle-level skills is not keeping pace with demand. Employers have the choice of hiring entry workers with these skills or upgrading employees through short training programs. In answer to a need to provide middle-level-skills training, colleges of applied arts and technology have been established; private vocational schools are an alternative. College programs provide a combination of general education and specialized skills. An important innovation has been the introduction of cooperative programs that involve work terms. To be sensitive to the demand for skilled human resources, the college system has allowed for interaction in the structure of colleges and in curriculum development. A balance is achieved between centralization and decentralization of college governance by dividing responsibility among the Ministry of Colleges and Universities, Council of Regents, and boards of governors of individual colleges. As the rate of technological change accelerates, colleges must anticipate changes in demand for skills. (Eight tables are appended.) (YLB)

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ED206912

REVIEW AND EVALUATION BULLETINS

Volume 2, Number 3
1981

Training for Middle Level Skills

CE 030105

Ontario Ministry of Education
Ministry of Colleges and Universities

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Training for Middle Level Skills

Hubert Saint-Onge

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Toronto, Ontario

MINISTRY OF EDUCATION CATALOGUING IN PUBLICATION

Saint-Onge, Hubert.
Training for middle level skills / by Hubert Saint-Onge. --

(Review and evaluation bulletins / Ontario Ministry of Education ; v. 2, no. 3)

Bibliography: p.

1. Technical education - Ontario. 2. Labor supply - Ontario. 3. Community colleges - Ontario. I. Ontario. Ministry of Education. II. Title. III. Series: Ontario. Ministry of Education. Review and evaluation bulletins ; v. 2, no. 3.

370.78 UTLAS: 54016005

ON02039

ISSN 0226-7306

ISBN 0-7743-6440-8

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Training for Middle Level Skills

The education system has the potential to preserve a balance between labour-market supply and demand. In order to do this effectively, educational planning and policies need to be responsive to changes in the demand for workers. Trends, developments in the labour market and the impact of economic and technological changes must be considered in the formulation of policies that govern the education system. Moreover, the structure and operation of the education system should be regularly reviewed to ensure co-ordination with labour-market developments.

Since high-technology industries are expected to play an important role in Ontario's future economic development, the educational system must be particularly attuned to the need for middle-level skills in the labour market. The purpose of this paper is threefold: to outline the role of workers with middle-level skills in the labour market; to describe how the current education system addresses the needs for training in middle level skills; and to identify the issues involved in bringing the education system for skilled workers into alignment with the labour-market demand.

The term "middle-level skills" is difficult to delineate for statistical purposes. It can be defined either as the skills possessed by a segment of the occupational spectrum or as the skills possessed by the graduates of a given sector of the educational system (i.e., the colleges of applied arts and technology in Ontario). This ambiguity makes the assembly of statistics problematic, since neither labour-force nor college-graduate data give an accurate picture of the role of skilled workers in the labour market.

Labour-force data also pose a problem of nomenclature: skilled workers are employed under a wide variety of job titles, including "assistant" and even "manager" in some ihstances. A 1975 study entitled The Engineering Technologist[1] found that one of the main difficulties in research on skilled workers is the lack of uniformity in job titles. The terms "technician" and "technologist" offer some indication of the need for middle-level skills, but they are not used consistently to designate all occupations that involve middle-level skills.

College-graduate statistics may not give the total picture either, since it is likely that a large number of skilled workers enter occupations through routes other than the colleges. Some skilled workers have university educations; others acquire their skills through extensive on-the-job training. Nevertheless, since more and more employers demand a college certificate or diploma when hiring workers with middle-level skills, a definition by level of education is used in the following examination of skilled labour. For the purpose of this paper the term "middle-level skills" refers to the training acquired by graduates of the two- and three-year programs in the Ontario colleges of applied arts and technology.

The Labour Market for Workers With Middle-Level Skills

The incidence of new labour-market entrants with middle-level skills provides a useful indication of current trends in the labour force. In 1976 graduates from the colleges of applied arts and technology represented 8.6 per cent of the new entrants in Ontario. In 1980 the percentage of these graduates rose to

10.1, and it is projected that it will reach approximately 14 per cent by 1985.[2] The dynamic impact of graduates with middle-level skills on the labour market is further demonstrated by the rapid proportional increase in their numbers (26.1 per cent between 1976 and 1981; see Table 1), and by their consistently high placement rate (80.9 per cent in 1976 and 89.4 per cent in 1979, see Table 2).

Labour-Market Participation

There is evidence that this supply is not keeping pace with the growing demand for skilled workers in Ontario's labour market. In a 1980 survey of employers the Economic Council of Canada found that Ontario's employers expected that approximately 6 per cent of the labour shortages that they anticipated in the near future will be in the middle-level-skills occupations. Shortages were projected for computer programmers and systems analysts (24 per cent), engineering and architectural technicians (17 per cent), and drafting and industrial designers (11 per cent).[3] It is not surprising then to find that individuals with middle-level skills are characterized by a relatively low level of unemployment.

Table 3 indicates that their unemployment rate (4.3 per cent in 1979) is considerably lower than that for secondary school graduates (7.6 per cent in 1979).

The development of new technologies in any sector of the economy affects both occupations and the demand for workers. New occupations are constantly emerging, and the job

functions of old occupations are constantly being revised as a result of rapid technological change. It is difficult to determine what exactly will be the impact of technological change on the level of skills required. For instance, a 1967 British study concluded that "within a broadly defined skill group such as skilled operatives, in some cases new technology 'de-skills' operations, while in others it increases the skills required."[4] However, the demand for unskilled workers generally declines as many of the more repetitive tasks in industry are assumed by machines. This is accompanied by an increase in the demand for workers with middle-level skills to maintain and operate equipment and machinery. A recent Canadian study, entitled The Effect of Technological Changes on Educational and Skill Requirement of Industry reasoned:

> If the technological change represents a radical departure from existing production process, it will likely cause the employment of appropriate technical occupations; similarly, if demand for the goods and services is increasing faster than the increase in productivity, necessitating an increase in employment generally, there will likely be additions to professional, managerial and supervisory personnel. This leads to the general conclusion that major technological changes in organizations facing rapidly increasing demand for their goods and services will have an upward effect on educational and skill requirements.[5]

This conclusion was supported by a comprehensive survey indicating that employers anticipated that 60 per cent of their employees would require upgrading of their technical skills and knowledge in the near future.[6]

In the face of this growing need for workers with middle-level skills, employers have the choice of either hiring new entrants to the labour force who have these skills or upgrading existing employees through short training programs. When questioned in one survey on the subject of training, an employer stated:

> The men who operate these machines are trained in-house, or by equipment builders ... If we require an N/C programmer, we hire one. If the newly hired programmer is unfamiliar with our programming language, he is sent to a service bureau for training.[7]

Another employer said:

> We did have difficulties to attract qualified N/C operators and programmers. However, we have overcome this problem by upgrading our own personnel through training courses at community colleges, in-house training, and courses conducted by our machinery suppliers.[8]

There is evidence that approximately 50 per cent of employers in Ontario are using some type of training program to supply existing workers with necessary skills and knowledge.[9]

Besides upgrading employees through training, employers are also changing the organization of work to use the skills of college graduates. A recent survey indicated that 60 per cent of college graduates obtained jobs for which employers specified middle-level-skill requirements.[10] Further evidence that the education and skills of these graduates are being utilized by employers is provided by the same study which indicated that 85 per cent of these workers experience high levels of job satisfaction.[11] It is not clear exactly how their skills are being utilized, since the job functions of skilled workers and the progress of these workers in the employment system are largely unexplored areas in Ontario.

The System of Middle-Level Professional Education and Training

Prior to 1966 workers entered the skilled occupations in Ontario through several routes, including university, upgrading from blue-collar positions, or immigration after receiving training abroad. As increasingly rapid technological advancement fostered growth in several branches of the economy, the demand for technicians and technologists outstripped the supply generated by these sources, and a need arose for a new sector of the educational system to provide middle-level-skills training. It was partly because of this need that the colleges of applied arts and technology were established in 1966 as an alternative to the universities in post-secondary education and training.

There are now twenty-two colleges with ninety campuses across the province offering a comprehensive array of occupationally oriented programs leading to diplomas or certificates in the areas of technology, business, applied arts, and health. The programs vary in length from several months to three years, and are offered on full-time and extension bases. The colleges also provide the "in-school" portion of apprenticeship programs, as well as a wide variety of skills training courses. They actively support training outside the institution through training-in-industry programs.

Since their creation the colleges have grown very quickly. In 1966 graduates from what were then called "institutes of technology" constituted 10 per cent of total post-secondary graduations. After the massive renewal and expansion of the system in 1966, the number of these graduates

increased rapidly to account for 30 per cent of total post-secondary graduations in 1976, and they are projected to account for 35 per cent in 1981 (see Table 1). College enrolment has grown by 624.7 per cent from 1966 to 1981, while the eighteen-to-twenty-four-year old population, which is the source for most full-time post-secondary enrolment, increased by only 60 per cent. Although reasons for this increase have not been formally studied, it would seem that a growing number of students are interested in the relatively short, occupationally oriented programs offered by the colleges. Another factor might be the excellent employment prospects for college graduates, as evidenced by their consistently high placement rates.

Private Vocational Schools

As an alternative to the publicly supported college system, private vocational schools also provide training and education aimed at producing skilled workers. These schools are licensed by the province, and their programs are validated by the Ministry of Colleges and Universities using the standards set for the colleges.

Private schools have enjoyed a steady growth. In 1973, there were seventy-two schools, and seven years later, in 1980, there were about two hundred. In 1977-78 the private schools had a total enrolment in all programs of 79 700, and, that same year, 38 443 full- and part-time students or 2.16 times the number of college graduates for the same year, graduated from private schools.

The program offerings in these schools include many that do not relate to skilled occupations. At the present time there is no way of determining exactly what percentage of private-school graduates find employment in middle-level occupations.

Content of College Programs

College programs are intended to provide an appropriate combination of general education and specialized skills. While their prime goal should be to teach the specific skills required for entry into an occupation, students also require a general educational base that will help them adapt to rapid technological change. The balancing of specific skills with general knowledge also facilitates some occupational mobility in the event that a student's skills become redundant or obsolete through new technologies. Thus, one-third of the courses in certificate and diploma programs provide general education.

The level of specialization varies considerably between technician and technologist programs. The former, which are four-semester programs, emphasize applied and practical skills. Technologist programs, which run six semesters, offer more theoretical, design-oriented training. Thus, while a technologist would assist an engineer in drafting plans, a technician would apply these plans to the production process. In 1978-79, 63.6 per cent of college graduates completed two-year programs, and 21.6 per cent completed three-year programs, while 14.6 per cent came from one-year programs (see Table 4).

Innovative Formats

One of the most important innovations in program offerings in recent years has been the introduction of co-operative programs in which work terms either alternate with, or are sequential to, academic terms. The costs of delivering co-operative programs are balanced by significant benefits. Studies have shown that work-experience terms tend to decrease the time graduates spend

between leaving school and obtaining employment. Moreover, 56 per cent of co-operative-program students found employment before completing their programs. Graduates of these programs are also more likely to obtain related jobs than are graduates from traditional programs (80 per cent as opposed to 60 per cent). College faculty members have expressed the belief that their institutions benefit from co-operative programs by becoming more responsive to the needs of industry and by keeping abreast of new developments and technologies in the field.[12]

Education and Labour Market Interaction

An educational system that is sensitive to the demand for skilled human resources must have bridging mechanisms with the employment system. Considerable effort has been made to allow for this interaction in the structure of the colleges and particularly in curriculum development.

The college system is characterized by a balance between the centralization and the decentralization of responsibilities for planning, program offerings, curriculum development, admission policies, and accreditation. It has been clear from the outset that if the community orientation of the colleges is to be preserved, individual institutions require some autonomy. On the other hand, co-ordination is necessary to ensure that all areas of the province receive a comparable level of educational opportunity and to maximize the use of available resources.

This balance of centralization and decentralization is achieved by dividing the responsibility for the governance of the colleges among three partners: the Ministry of Colleges and Universities, the Council of Regents, and the boards of governors

of the individual colleges. The Ministry and the Council of Regents provide central co-ordination. The Ministry's role is to establish and maintain the colleges as well as to govern their overall direction where uniform policies are required. The Council of Regents is responsible for assisting the Minister in planning, establishing, and co-ordinating the programs and services offered by the colleges. The boards of governors represent the interests of the local communities served by each college; they set the educational goals and policies appropriate to their respective communities and evaluate the performance of their colleges.

Program Selection

Since the colleges are designed to serve the needs of their respective communities, the same programs may be offered by several institutions. This imposes the need for some standardization of curriculum. Therefore, the Ministry of Colleges and Universities has adopted a policy of establishing program guidelines for all college programs. These guidelines define competency benchmarks and outline terminal performance objectives. The task of developing the initial versions of the guidelines is usually assumed by one or several colleges under a specific contract. Draft guidelines are then vetted through consultative mechanisms involving senior college personnel and industry representatives. While modifications to program guidelines are being made constantly, major revisions are done at five-year intervals. It is possible that accelerated technological change will make more frequent revisions necessary in some program areas.

The colleges are responsible for proposing new program initiatives. Each institution has an advisory network of industry and some labour representatives who recommend changes or new initiatives in program development, educational content, and level of activity. These advisory committees represent the main mechanism to ensure that programs correspond to labour-market needs. The program proposals are then examined by the Council of Regents, which in turn makes recommendations to the Minister of Colleges and Universities for final approval. Efforts are continually being made to improve the information base for program planning.

At this stage in the evolution of the college system, two main issues concerning the relationship between educational and labour-market policies have emerged: the balancing of the competing goals of the college system, and the interface between educational planning and economic development.

The goals of the college system could be viewed as, first, to provide individuals with education and training to maximize their abilities and to allow them to gain entry into the occupations of their choice; second, to provide skills for which there is a demand in the economy; and third, to provide the skilled labour force required for meeting provincial economic priorities. There is a constant trade-off among these goals, because career choices on the part of individuals may not always reflect labour-market needs and local labour-market needs may not reflect provincial economic priorities. Consequently, college program offerings include courses for which there is a great deal of student interest and little labour-market demand. Colleges may also sometimes continue to offer established programs for which there is a demand even though the programs do not coincide with provincial priorities.

The colleges have at times been slow to adjust to emerging economic priorities. For example, from 1971 to 1978, the total number of college graduates doubled, but graduates in the technology programs increased by only about 30 per cent (see Table 5). Furthermore, in 1976, 45.5 per cent of college graduates were employed in the medical and secretarial/clerical sectors, while only 9.2 per cent entered data processing, engineering, and architectural occupations, in which shortages are now emerging (see Table 6).

Table 7 indicates that the percentage of enrolments in technological programs was 28.2 per cent in 1971, 23.8 per cent in 1976, and 25.1 per cent in 1980. Table 8 shows that the percentage of graduates in the technology area has varied from 31.5 per cent in 1971, to 18.3 per cent in 1976, to 20.4 per cent in 1978. Although program cost and funding considerations have contributed to a relatively slow rate of growth for technology programs, the pressure of student demand for programs that are less related to economic needs has undoubtedly influenced the evolution of program offerings. Measures such as special funding incentives are being considered to facilitate better co-ordination of program activities and labour-market needs. The Ministry is currently reviewing changes that will provide for the introduction of new program offerings at the provincial (i.e., Ministry) level as well as at the community (i.e., college) level.

Until now the relationship between the colleges and the economy has been a reactive one: when skills shortages become apparent, the colleges respond by providing education/training in the appropriate program areas. As the rate of technological advancement accelerates, colleges must learn to anticipate changes in the demand for skills. The competitive edge of Ontario's

economy can be reinforced through educational planning that is geared to economic-development strategies. For this to be possible, however, the colleges must be recognized as an integral element of the province's strategy for economic development.

Whereas the expansion of manufacturing activity in Ontario was constrained by a deficient infrastructure in the 1950s and 1960s and by a shortage of capital in the 1970s, there is growing evidence that the greatest impediment to growth in manufacturing in the 1980s will be the shortage of skilled labour. A recent survey of Canadian manufacturers has shown that 12 per cent of employers identified shortages of skilled labour as a source of production difficulty, while 3 per cent identified working capital as a problem.[13] One employer stated, in another survey, that "the lack of [these] skills ranks with the capital crunch as the main factor limiting growth".[14] It is reasonable to assume that the availability of skilled workers would influence the decisions of investors on whether to locate or expand production facilities in Ontario.

Trade barriers are gradually being removed, bringing a more intense competition for world markets. At the same time, developing countries will play an increasingly important role in manufacturing goods for world markets. Producers in countries such as India, Egypt, Nigeria, and Indonesia will benefit from a vast labour pool and low labour costs. In order to compete in this environment, Canada will need to specialize in those fields of production that have a maximum of competitive advantages. These advantages will be found in the development of a highly skilled and well-educated labour force. The Economic Council of Canada has summarized this as follows:

> It was from the very great improvement of educational infrastructure, widening of university enrolment, and enrichment of post-graduate training that we obtained the highly skilled and knowledgeable work force that we now have. The natural corollary is that we proceed from this base to build an indigenous innovation capability so as to be able to apply this educational capital to advanced industrial and post-industrial applications.[15]

Like Canada as a whole, Ontario cannot afford the luxury of waiting for new technology to be developed in other countries and then seeking to implant it in its own production facilities. If we are to become, and to remain, competitive, much effort must be made to continuously improve products and processes through research and development. This cannot be done without corresponding efforts to sustain a training system capable of generating the skilled human resources required to develop and apply technological innovations. Accordingly, planning for research and development activities must be closely connected with educational planning.

Table 1: Post-Secondary Enrolment and Graduates in Ontario, 1966-1981

	1966	1971	1976	1981	Percentage Change 1966-71	1971-76	1976-81	1966-81
Enrolment								
College full-time	10 267	37 981	58 919	74 400	269.9	55.1	26.3	624.7
University full-time Undergraduate	60 862	110 329	144 481	138 000	81.3	31.0	-4.5	126.7
Graduates								
College	1 385	8 687	16 501	20 800 [1]	527.2	90.0	26.1	1 401.8
University bachelor and first professional degree	12 751	28 047	38 911	36 300	120.0	38.7	-6.7	184.7
Population 18-24	727 405	946 235	1 058 220	1 160 684	30.1	11.8	9.7	59.6

[1] Ministry projections

Source: Statistics Canada, Advance Statistics of Education

Table 2: Employment of College Graduates in Ontario in Jobs Related/Unrelated to Their Programs

	1976	1979
A. Total graduates	16 871	18 102
B. Number available for work	13 010	14 540
C. Number working as a per cent of B	80.90% (10 525)	89.44% (13 004)
D. Number working in related jobs as a per cent of C	88.58% (9 323)	91.75% (11 931)
E. Number working in unrelated jobs as a per cent of C	11.42% (1 202)	8.25% (1 073)

Source: Ministry of Colleges and Universities, "Colleges of Applied Arts and Technology Graduate Placement Reports", 1975-76 and 1978-79

Table 3: Employment Rates by Educational Attainment

	1976	1979
All labour force	6.2	6.5
Secondary school	7.3	7.6
Some Post-secondary	5.6	5.8
Post-secondary certificate or diploma [1]	4.4	4.3
University degree	3.4	2.9

[1] This category corresponds to middle level skills occupations.

Source: Statistics Canada, The Labour Force, December 1976 and 1979

Table 4: Distribution of College Graduates by Program Duration

	1975-76		1978-79	
	Number	%	Number	%
One-year program	1 977	11.8	2 727	14.6
Two-year program	11 199	66.3	11 840	63.6
Three-year program	3 695	21.9	4 024	21.6
Total	16 871	100.0	18 591	100.0

Source: Ontario College Information Service data

Table 5: Graduates from Community Colleges by Program Field, Ontario, 1971-78

	1971	1976	1978	Percentage Change 1971-76	Percentage Change 1976-78	Percentage Change 1971-78
Applied Arts [1]	2 056	3 522	3 744	71.3	6.3	82.1
Business	2 976	4 268	4 866	43.4	14.0	63.5
Health [2]	346	4 657	4 313	1 246.0	-7.4	1 146.5
Technology [3]	2 711	3 018	3 582	11.3	18.7	32.1
Other	523	1 036	1 055	98.1	1.8	101.7
Total	8 612	16 501	17 560	91.6	6.4	103.9

[1] Includes community and social services

[2] Includes nursing

[3] Includes natural resources

Source: Statistics Canada, Enrolment in Community Colleges

Table 6: 1975 Ontario College Graduates Employed Full-Time, by Occupational Sector, September 1975 and 1976

Occupational Sector	CAAT[1] Graduates	
	September 1975	September 1976
	Per cent	
Natural resources	1.9	1.7
Education	5.9	4.9
Medicine and health	23.9	25.8
Secretarial, clerical	19.5	19.7
Data processing	2.6	2.6
Management	2.4	3.6
Economics, finance, accounting	3.4	3.3
Purchasing and sales	6.4	5.4
Life and physical sciences, mathematics	1.4	1.3
Engineering, architecture	7.5	6.6
Community and social services, recreational	3.6	3.6
Journalism	-	-
Mechanical and electrical construction	6.7	6.1
All others	14.8	15.4
Total	100.0	100.0
Total number	7 739	9 070

[1] Colleges of Applied Arts and Technology

Source: Statistics Canada

Table 7: Percentage Distribution of Full-Time Enrollment in Community Colleges by Program Field, Ontario, 1971-1980

	1971	1976	1980
Applied Arts [1]	25.9	24.2	24.6
Business	34.5	28.6	30.9
Health [2]	4.2	18.5	12.4
Technology [3]	28.2	23.8	25.1
Other	7.1	5.0	7.0

[1] Includes community and social services

[2] Includes nursing

[3] Includes natural resources

Source: Statistics Canada, Enrolment in Community Colleges

Table 8: Percentage Distribution of Graduates from Community Colleges by Program Field, Ontario, 1971-1978

	1971	1976	1978
Applied Arts [1]	23.9	21.3	21.3
Business	34.6	25.9	27.7
Health [2]	4.0	28.2	24.6
Technology [3]	31.5	18.3	20.4
Other	6.1	6.3	6.0

[1] Includes community and social services

[2] Includes nursing

[3] Includes natural resources

Source: Statistics Canada, Enrolment in Community Colleges

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